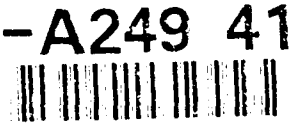

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INTEGRATION OF CLASS IX RETAIL SUPPLY INITIATIVES

BY

Mr. Clarke J. Fox

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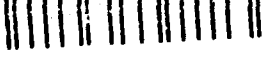

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INTEGRATION OF CLASS IX RETAIL SUPPLY INITIATIVES

AN INDIVIDUAL STUDY PROJECT

by

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ABSTRACT

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New logistics concepts are under development in the U.S. Army to provide more affordable and responsive support in both peacetime and wartime. The impetus for these innovations include the lessons learned from Desert Storm, changes in battlefield doctrine, and the cost reduction directives of the 1990 Defense Management Review. In particular, the Class IX (repair parts) retail supply system is the focus of numerous initiatives to reduce costs and improve responsiveness. These initiatives have not been developed in a totally coordinated manner. Several of the Class IX initiatives have been developed by the Strategic Logistics Agency; other initiatives have been developed by various Department of the Army agencies and activities. The purpose of this paper is to determine the relationships between these initiatives, the consistency in their objectives, and how they can be integrated in a coherent repair parts system. The focus in this effort is to evaluate whether these initiatives comprise a repair parts strategy for reducing costs, maintaining readiness, and supporting AirLand Operations as well as the national military strategy of forward presence, crisis response, and reconstitution.

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INTEGRATION OF CLASS IX RETAIL SUPPLY INITIATIVES

I. Introduction

Logistics support concepts in the U.S. Army are undergoing significant review and change as a result of the current political and economic environment. Declining resources, future force reductions, and changes in the national military strategy and battlefield doctrine will have a far-reaching impact on supporting and sustaining weapon systems.

In this climate of change, the Class IX (repair parts) supply system is the focus of numerous initiatives to reduce costs, increase efficiency, and improve responsiveness to the user. These initiatives include a re-examination of the Combat ASL/PLL program from the 1980s as well as new concepts such as Sparing to Availability (STA), Stock Funding of Depot Level Reparables (SFDLR), Objective Supply Capability (OSC), Total Asset Visibility (TAV), Usage Based Requirements Determination (UBRD), Readiness Based Maintenance (RBM) and Battlefield Spares System (BSS). Other initiatives address long-standing problems with excess inventory reduction and support for low density systems.

These repair parts initiatives have not been developed in a totally coordinated manner. Some of these concepts have been developed and coordinated by the Strategic Logistics Agency, a field operating agency under the Department of the Army Deputy

Chief of Staff for Logistics (DA DCSLOG). Other initiatives mentioned above have been developed independently by other DA organizations. The purpose of this paper is to determine the relationships between these initiatives, how they complement each other, and how they can be integrated. The initiatives will be evaluated in terms of their value in developing a retail repair parts supply system that can simultaneously achieve the following objectives:

- Comply with directives to reduce costs.
- Maintain the readiness and sustainability of the forces required under the national military strategy; i.e., forces to support forward presence, contingencies, and reinforcement.
- Support emerging AirLand Operations doctrine with its requirements for flexibility, anticipation, and responsiveness.

The impetus for these Class IX initiatives, and new logistics support concepts in general, is based on several key developments. The decline of the Soviet threat in Europe has resulted in domestic pressures to reduce force structure and cut overall defense costs. This presents the challenge of maintaining the readiness and sustainability of increasingly complex weapon systems with a shrinking pool of resources. At the same time, the Army must work jointly with the Navy and Air Force to develop power projection capability of a primarily CONUS-based force for a variety of contingencies. The

requirement to respond rapidly to these contingencies with sufficient support will place a significant burden on the logistics system. The difficulties in supporting a contingency operation were evident during Operation Desert Shield when time and distance factors combined to severely stress the Army logistics system.[1]

The Defense Management Review (DMR) completed in 1990 has also imposed a further challenge on the Army with a series of directives having a far-reaching impact on logistics operations. With a goal of reducing overhead costs while maintaining military strength, the DMR stressed business-like efficiencies through better management control systems:

> It has become evident that the current policies and procedures have served to impede improved operations and may have increased the cost of doing business by not allowing the flexibility to make smart management decisions.... One of the major changes needed is a change in mind-sets. Supply managers must see and understand-must have visibility-of the costs of their operations and the willingness to make trade-off decisions to do what is best in the interest of the Department.[2]

The Defense Management Review Decisions (DMRD) which impact on the Army's logistics operations include:

DMRD 901: Reduce Supply System Costs

DMRD 904: Stock Fund Depot Level Reparables

DMRD 927J: Integrate Wholesale and Retail Logistics

In addition to the DMR emphasis on efficiencies, the wartime focus of logistic support systems must also adjust to evolving AirLand Operations doctrine with its requirements for flexibility and anticipation on the non-linear battlefield.[3]

In view of these developments, it is evident that major changes in logistics operations, particularly Class IX supply, will be required to accomplish the opposing objectives of reducing costs with no decline in readiness, and improving peacetime efficiencies while also being prepared for wartime contingencies. In this study the Class IX initiatives will be evaluated in the context of these objectives. The major features of the current retail Class IX supply system are first described to provide the proper perspective for evaluating the proposed changes. The various Class IX initiatives will then be presented in terms of their purpose, objectives, and development status. Next, the supply system processes and the key issues addressed by the initiatives will be identified as a framework for integrating the concepts and determining changes that may be required to some initiatives. Conclusions and recommendations will then be made based on how well the initiatives and the issues which they address can support a repair parts supply strategy for reducing costs, maintaining readiness and sustainability, and supporting AirLand Operations doctrine.

II. The Current Class IX Retail Supply System

The Class IX supply system is divided into two organizational categories, wholesale and retail. The wholesale system consists of six National Inventory Control Points (NICPs): Missile Command (MICOM), Communications-Electronics Command

(CECOM), Tank-Automotive Command (TACOM), Troop Support Command (TROSCOM), Aviation Systems Command (AVSCOM), and Armaments, Munitions, and Chemical Command (AMCCOM). The NICPs are supported by supply and maintenance depots. The wholesale level is responsible for requirements computations, cataloging, procurement, depot repair, and distribution.

At the retail level, there are three echelons of maintenance requiring repair parts support: intermediate general support (IGS), intermediate direct support (IDS), and organizational. The organizational level is supported by a Prescribed Load List (PLL) of repair parts. Repair parts on a company PLL are required to meet specific demand criteria: a part must have at least 3 demands per 180 days to qualify for stockage; 1 demand per 180 days is required to retain a part on the PLL. Units were formerly required to augment their PLLs with a Mandatory Parts List (MPL) for combat stockage. This requirement was suspended in 1990.

Except for aviation, PLLs of the companies in a battalion are sometimes brought together in the battalion trains and placed under the supervision of the battalion motor or maintenance officer. However, while unit PLLs may thus be co-located, they are not consolidated. Co-location is simply a management arrangement whereby a central maintenance facility for the battalion is established.

The source of supply for using units is normally an intermediate direct support (IDS) maintenance company. This

direct support unit maintains an authorized stockage list (ASL) which should include all items that are on the PLLs of supported units. Thus the ASLs are said to umbrella the PLLs. The ASL should also include those parts required to perform maintenance tasks at the IDS maintenance level.

The ASL must also satisfy specific demand criteria: 9 demands per year to add a part to the ASL; 3 demands per year to retain a part. A division ASL is usually divided between three Forward Support Battalions (FSB) and the Main Support Battalion (MSB).

The funds for spare parts are divided into stock funds and procurement appropriation funds. The Army Stock Fund (ASF) purchases consumable items, and procurement appropriation funds are used to purchase higher cost reparable items. The Army stock fund is a revolving capital fund which is reimbursed by customers for consumable items. The high cost depot level reparable items are currently issued at no cost to the customer.

The current system as described above is deficient in several areas. Retail stockage criteria are not based on readiness considerations and cost trade-offs between stock items are not possible. As a result of outdated technology and manual processing, requisitions may take as long as 14 days after submission to just reach the national supply point.[4] Units do not have the go-to-war stocks which were formerly provided under a Mandatory Parts List. The system is not responsive to contingency operations as evidenced during Operation Desert

Shield when 10 to 12 days were needed to get a requisition out of the theater.[5] With a lack of asset visibility, many requisitions were passed to CONUS when the needed items were already in theater.[6] The next section presents the Class IX initiatives which are under development to overcome these deficiencies and meet the requirements of the DMR, the national military strategy, and AirLand Operations doctrine.

III. Class IX Initiatives - Purpose, Objectives, and Status

Combat Authorized Stockage List (ASL)/Prescribed Load List (PLL)-

In 1979, the Army Chief of Staff expressed concern with the ability of peacetime PLLs and ASLs to support units in combat.[7] Peacetime PLLs and ASLs are based on peacetime demands and do not take into account increased wearout rates or damage associated with combat. In addition, reviews of unit PLLs showed a great difference in the type and level of stockage of repair parts - even between units in the same battalion.[8]

In order to make PLLs and ASLs more combat ready, the Army Chief of Staff directed initiation of a Combat ASL/PLL program. The intent of this program was to require units to stock selected essential repair parts to sustain their equipment in combat.[9] This selection of repair parts was keyed to individual end items, with the repair parts selection being termed a Mandatory Parts List (MPL).

The individual end items for which a Combat ASL/PLL were to be developed were determined by TRADOC and designated the Mission Profile Development List (MPDL). The Major Subordinate Commands (MSCs) of the Army Materiel Command (AMC) then determined which parts were candidates for stockage on the Combat ASL/PLL. These parts were termed the Candidate Item File (CIF).[10]

The stockage quantities of these parts on the Combat ASL/PLL were based on a cost-optimization model developed by the Army Materiel Systems Analysis Activity (AMSAA). This model produced the least cost set of spares to insure a 90 per cent operational availability based on the increased usage of the end items during combat. The increased usage was based on 15-day mission profiles developed by the service school having proponency for the end item.[11]

Mandatory Parts Lists (MPLs) for the PLL were developed and published in two DA Pamphlets. Changes to Army Regulation AR 710-2 and DA Pamphlet 710-2-1 were incorporated to define the policy for a Combat PLL Mandatory Parts List (MPL):

> A combat PLL will consist of-
> Repair parts prescribed by a mandatory parts list (MPL) for equipment on hand. ...[12]
>
> A combat PLL is mandatory in those Active Army TOE units, USAISC, and INSCOM units designated by a mandatory parts list....
> All D to D+60 deploying forces of the ARNG and MTOE USAR organizations will maintain a combat PLL consisting of parts required for stockage by an MPL...[13]

The Combat ASL was also alluded to in AR 710-2, allowing stockage of "items supporting published combat ASLs."[14] However,

as a result of funding constraints, Combat ASLs were never published or fielded. In March 1990, citing user dissatisfaction with MPLs and funding difficulties, DA DCSLOG directed that a relook of the entire MPL program be conducted by the Army Materiel Command.[15] Since that time, the Army Materiel Command has demonstrated the value of the Combat ASL model by developing push packages of repair parts for Operation Desert Storm. The Combined Arms Support Command (CASCOM) has also developed a concept for deployment combat ASLs to support the FORSCOM contingency corps. These stocks would be developed for each Direct Support Unit in the contingency forces. The deployment combat ASL would be stored in CONUS depots with the drawers, bins, and shelves needed for mobility purposes. In the event of a contingency requirement, the stocks would be released from the depot and shipped to the point of embarkation of the unit or to the appropriate location in theater.

In addition to the CASCOM deployment ASL, other concepts for wartime contingency stocks are still evolving within the Aviation Systems Command and the Tank-Automotive Command.

Battlefield Spares System (BSS)

Whereas the Combat ASL/PLL program addressed stockage levels for wartime, the Battlefield Spares System (BSS) is a recent initiative by the Quartermaster Center and School to define how retail stocks should be managed in wartime as well as peacetime.

The purpose of the BSS is to provide a more efficient,

responsive, and cost-effective means of managing repair parts.[16] This initiative is a response to reports that current supply policies are inefficient and ineffective, and have contributed to the generation of excess stocks.[17]

The unique characteristic of BSS is the ownership of the ASL by Forward Support Battalions (FSB) rather than by the division. Unit PLLs will be eliminated and replaced by "slices" of the ASL that are tailored to support individual battalions and are located forward as sublocations of the ASL. The ASL is seen as distributive; that is, positioned in several locations to ensure responsiveness. A few parts that can be replaced by crew members will be carried on weapon systems as on-board spares.

The BSS concept is consistent with emerging Combat Service Support (CSS) concepts for AirLand Operations doctrine which removes significant logistics functions from maneuver units so that they can develop the quickness needed to concentrate on fighting.[18]

A major feature of BSS is rapid delivery to provide parts to Unit Maintenance Collection Points from the supporting forward ASL.[19] Both scheduled and as-required deliveries will be made with vehicles and drivers under the operational control of the Forward Support Battalion. Scheduled delivery routes will be designed to minimize response times. As-required deliveries will be handled the fastest way possible, including the use of air assets if available.[20]

Poorly trained PLL clerks have been cited as a major source

of requisitioning problems under the current supply system.[21] These personnel do not get sufficient credit, rank, and training for the importance of the job which they perform.[22] Under BSS, well-trained senior supply soldiers will be responsible for all aspects of requisitioning, issue, maintaining records, and customer assistance. They will also be equipped with communications and automatic data processing equipment that will provide visibility and control of parts to allow cross-leveling from one forward ASL location to another.[23]

The BSS also provides for a modification of decision criteria for stockage. These rule changes will include consideration of cost and anticipated demand. The decision to stock will be based on insuring the availability of supported equipment.[24]

The advantages of BSS are seen as: providing professional supply supervisors rather than inexperienced PLL clerks; eliminating the unnecessary layering of stocks; centralizing the Class IX management; and improving supply responsiveness through enhanced visibility, cross leveling of repair parts, and rapid delivery by dedicated transportation. The automated visibility of stocks is also expected to reduce the likelihood of excesses being generated at the user level.[25]

At this time, the BSS concept is still under review by the Quartermaster School to determine requirements for transportation, training, and supply automation software.

Objective Supply Capability (OSC)/Total Asset Visibility (TAV)

The DOD Defense Management Review completed in 1990 mandated that wholesale and retail logistics be integrated. The Defense Management Review Decision (DMRD) 901 specifically cited "visibility of retail and operating stocks" as a means of reducing Army supply system costs.[26] The DMRD 901 describes the benefits of visibility of operating, wholesale, and retail stocks:

> In some instances the wholesale manager has some visibility of all three levels of inventory. Even though wholesale stocks may be low, sufficient assets may be available in retail, and if there is visibility of those assets, the manager may preclude procurement to replenish the wholesale stocks.[27]

However, DMR 901 indicates that such asset visibility is not common-place:

> Total asset visibility is not available to all item managers resulting in unnecessary increases in inventory to meet perceived shortages... the existing system results in unacceptable increases in costs and unnecessary inventory.[28]

In response to DMRD 901, The Objective Supply Capability (OSC) and Total Asset Visibility (TAV) initiatives are efforts of the Strategic Logistics Agency to achieve visibility of stocks and the development of a single, "seamless" supply system. In the current structure of separate wholesale and retail systems, the wholesale system loses visibility and control of items after issue. If a retail unit needs an item, the wholesale system is unable to determine if the item is available in another unit. The only alternative is then to procure the item unless it is available at a wholesale depot. In a single supply system, the

integrated system's manager would have total visibility of the Army's inventory from "depot to foxhole".[29] With this visibility, a manager can redistribute items from locations as an alternative to additional procurement expenditures.

The Objective Supply Capability is a concept to streamline the requisitioning process and overcome delays in the wholesale and retail systems. In the current supply environment, each request initiated at the user level may be processed through several sequential retail level supply systems before it is received at the wholesale level of supply. Requests may take up to 14 days after submission to reach the national supply point.[30]

The OSC will use improved communications and advanced automation techniques to permit same-day processing of customer supply requests; provide customers with immediate status of their requests; and ensure that a lateral search and issue of all available assets on the customer's installation or within his geographical area is made before unfilled requests are passed to the wholesale supply system.[31] A financial interface will be developed so that a unit which is giving up a part will receive full reimbursement and the stock fund account of the gaining unit will be decremented.[32] For high priority requests, the gaining unit will arrange expedited transportation for the part. The Battlefield Spares System previously discussed also emphasizes the need for lateral supply and cross-leveling.

The OSC is actually a collection of modifications to existing Standard Army Management Information Systems (STAMIS),

combined with an electronic gateway that links the operation of those systems. The gateway will contain the necessary information for making decisions while processing requests. This information will include copies of the asset balance files for each direct support supply activity in the Army. The gateway software will return status information to the requestor within minutes. The gateway will also process the request to the appropriate level of supply in 1 day instead of 14 days.[33]

The OSC is expected to contribute to greater weapon system availability and more cost-effective logistics support. This will be possible through enhanced asset visibility and reduced order and shipping time which will allow the Army to decrease on-hand inventory.[34]

The OSC concept was tested at Ft. Hood, Texas in the fall of 1988. An expanded proof of principle demonstration was conducted through March 91. During the testing, the order ship time (OST) for Ft. Hood was reduced to 6-7 days as compared to the pre-OSC OST of 15-25 days.[35] The Program Executive Officer for Standard Management Information Systems (PEO STAMIS) now has responsibility for further development and fielding of OSC.

Total Asset Visibility is intended to support OSC by increasing the visibility of Class IX stocks. To meet this goal, both existing and emerging processes and capabilities are being used to obtain near real-time visibility of Army assets by quantity, condition, and location - whether they are in the hands of soldiers, in storage at a retail or wholesale stockage point,

or moving between source and destination.[36]

In a proof of principle test completed with the Multiple Launch Rocket System (MLRS) in February 1991, the TAV concept was successful in gaining visibility of wholesale and retail stocks as well as in-transit stocks. A "gateway" to the Army Missile Command provided wholesale procurement data. A second gateway to a prototype OSC data base was used to retrieve retail level data. In-transit assets were accessed through a U.S. Army Transportation Command visibility system prototype.

The target date for completing the full scale development and fielding of TAV is the end of FY94.[37]

Readiness Based Maintenance (RBM)

The emphasis on high technology weapons has increased the importance of rear-echelon logistics structures in maintaining combat readiness. Components for high-technology weapon systems are expensive and may be scarce in both peacetime and wartime due to budget constraints. The unpredictable failure rates of these components also make their demand difficult to forecast in peacetime and even more so in wartime. Readiness Based Maintenance (RBM) is a decision support system developed for the Army by the RAND Corporation to provide more responsive supply support under these conditions of uncertainty.

The RBM process is based on the assumption that the Army can no longer afford to maintain operational availability goals of weapon systems by accumulating huge stocks of parts in the supply

pipeline. The focus is to create a decision logic which will recommend priorities for the repair of high technology components, distribution of assets in storage, and redistribution of repaired components.

The RBM decision support system uses an algorithm called Distribution and Repair in Variable Environments (DRIVE) to prioritize repair and distribution actions at each echelon. It maximizes the probability of achieving specific availability goals over a given time with available resources. RBM will process weapon system availability goals, current force structure, anticipated operating conditions, and current spare part positions to produce decision recommendations for repair and distribution of assets.

Simulations have demonstrated the effectiveness of RBM in the following areas: DS level repair of M1 tank and Bradley Fighting Vehicle components in a main support battalion; theater level repair of the Apache helicopter Target Acquisition System; and depot level repair of M1 and Bradley components. The RBM is undergoing further proof-of-principle tests to demonstrate the decision support system at various echelons.

Sparing to Availability (STA)

Sparing to Availability (STA) is an alternative to current supply policy in AR 710-2 for developing ASL and PLL requirements. Under STA, the ASL and PLL stockage levels are computed to provide specified levels of end item availability at

least cost. This computation technique uses a cost optimization model which considers parts cost, supply structure, order and ship times, and demand rates.[38]

Sparing to availability recognizes that the goal of the supply/maintenance structure is to support weapon system availability requirements. It follows that the goal of stockage lists issued to units should be to ensure that supply shortages do not cause a weapon system's operational availability to fall below required levels. There will be many stockage lists which will provide the required level of operational availability. The sparing to availability concept ranks the alternative stockage lists by their costs and selects the least expensive list. To accomplish this ranking, sparing to availability assesses the impact of spares on both weapon system availability and total costs. For example, a part that has twice the demand rate of another part will have a correspondingly greater impact on operational performance. For each part, sparing to availability can determine the marginal increase in operational performance per increase in unit spares cost. In this manner, the most cost-effective quantity of different parts can be added until the operational availability requirement is supported.

Stockage levels under the current retail supply procedures in AR 710-2 are not related to a weapon system availability goal. The AR 710-2 criteria merely establish a fixed number of demands that are required to add or retain a part. For the PLL, 3 demands per 180 days are required to add a part; 1 demand per 180

days is required to retain a part. At the ASL, 9 demands per year are required to add a part; 3 demands per year to retain a part.[39]

These add/retain criteria are not related in any manner to weapon system availability. Low density systems in particular will have difficulty in generating sufficient demands to justify stockage. Moreover, studies have shown that a large portion of Not Mission Capable Supply (NMCS) requests and cannibalization actions are for Non Stockage List (NSL) items which do not meet the add/retain criteria of current Army policy.[40]

In spite of these problems, the Army has been able to maintain acceptable readiness levels. In many cases this is due to special management actions; for example, critical items are provided mandatory parts lists; units decide to stock non-demand supported items; units institute their own lateral resupply actions; special stocks are ordered before exercises. Studies have shown, in fact, that large portions of field stockage does not adhere to AR 710-2 policy.[41] These ad hoc approaches, while they provide some measure of success in terms of meeting readiness, are inefficient and costly.

The advantages of sparing to availability have been recognized in previous studies and guidance. The sparing to availability concept was stated as an objective of DOD in the Defense Guidance related to the FY 84 POM:

> Our objective is to size and fund peacetime operating secondary item inventories to support programmed weapon system availability rates and operating tempos. ... the Services will develop and institute, by end FY85, the ability

> to size weapon system initial and replenishment secondary item inventories to meet explicit weapon system availability and operating tempo objectives.[42]

A study by the Logistics Management Institute (LMI) under contract to DOD recommended as early as 1982 that

> Requirements for spare and repair parts should be computed to provide specified levels of readiness and sustainability at least cost.[43]

In spite of this guidance it was not until recently that sparing to availability made its first inroads into Army supply policy. In April 1990, after completion of the AMC Provisioning Systemic Review, the Commanding General of AMC directed that all AMC elements use sparing to availability for the initial provisioning of Army weapon systems.[44] The Army provisioning regulation AR 700-18 was also rewritten to require that provisioning be conducted with a sparing to availability approach.

The benefits of sparing to availability during the initial provisioning period will not be sustained beyond the two year provisioning period unless action is taken to incorporate sparing to availability into the replenishment phase of ASL/PLL stockage. The Army Materiel Systems Analysis Activity (AMSAA) has developed procedures to extend the sparing to availability concept to the replenishment phase. Several divisional stockage lists under current supply policy have been compared with a sparing to availability generated ASL. These results indicate that a significant reduction in retail stock investment is possible with sparing to availability while maintaining readiness goals.

However, to further refine the ASL stockage levels under sparing to availability, a field demonstration and review with an active Army division is required. These actions are being pursued by AMSAA and the Strategic Logistics Agency.[45]

Other Services have implemented STA methodology for initial provisioning and replenishment. For initial provisioning, the Air Force has developed the Aircraft Availability Model (AAM) while the Navy has developed the Availability Centered Inventory Model (ACIM). The Air Force also uses a STA methodology for determining replenishment levels for reparable items. On selected systems, the Navy has used an STA approach for determining replenishment levels.[46] The STA methodologies used by the Air Force and the Navy are based on the same principles as the Army methodology in achieving a weapon system availability at least cost. The only significant difference is the aircraft orientation of the Air Force methodology which assumes a two echelon maintenance structure of base and depot.[47] The Army and Navy methodology can model any number of maintenance echelons.

Usage Based Requirements Determination (UBRD)

Usage Based Requirements Determination is an SLA initiative to review, develop, and integrate automated logistic information for provisioning, cataloging, and supply management. A primary objective of UBRD is to insure that supply optimization models are consistently used throughout the requirements process both at wholesale and retail levels. The need for increased data

accuracy in these models is also emphasized by UBRD.

In the initial provisioning process, UBRD is developing the means to use actual field data to make adjustments to failure rates based on preliminary engineering estimates. Improvement in the accuracy of these failure rates will increase weapon system availability, reduce costs, and reduce excess stocks.

Additional efforts in the requirements determination process under UBRD are planned for the use of optimization models and improvement of data accuracy at the retail replenishment level of supply. SLA is working with AMSAA to demonstrate the efficiency of a multi-echelon STA optimization model that will generate these retail supply requirements.

Support for Low Density Systems

Initiatives to improve the readiness of low density systems are closely related to sparing to availability concepts. Providing adequate support for low density systems has been a persistent problem in the Army. One of the primary contributing factors to readiness deficiencies of these systems is the add/retain stockage criteria in current retail supply policy. Under these criteria, low density systems cannot generate sufficient demands to justify stockage. The sparing to availability concept overcomes this deficiency by specifically providing the stockage required to achieve a readiness goal.

The sparing to availability concept for low density systems is also recognized in a study conducted for CECOM. This study

concluded that for low density systems,

> Spares demands are generally low and tend to be diffused over a wide range of components...This requires stockage issue and retention under readiness-oriented sparing regulations and policies.[48]

The Tank Automotive Command also completed a low density test at Ft Carson, CO in 1991 using sparing to availability stockage criteria. Supplemental packages of parts based on STA were provided for three test vehicles: the AVLB, CEV, and M916. Over the five month test period, each test vehicle demonstrated increases in readiness for a small investment in repair parts.

Stock Funding of Depot Level Reparables (SFDLR)

The Stock Funding of Depot Level Reparables (SFDLR) is a major initiative of the Army's Strategic Logistics Program to reduce Class IX supply system costs. Under this initiative, the financing of all depot-level reparable secondary items is transferred from procurement appropriations to the Army Stock Fund (ASF). The Army Stock Fund is a revolving, working capital fund designed to finance supply pipelines between vendors and users (units). The ASF works like a commercial business in purchasing products which are then sold to customers (units) for cash. The cash then replenishes the ASF.

Under SFDLR, the ASF will finance the previously procurement-funded items. These are mostly high dollar depot reparable items that were previously issued for free. Units will now reimburse the ASF for these items.

The stock funding of depot level reparables was directed by

Defense Management Review Decision (DMRD) 904. The DMR cited previous Navy experience with stock funding which indicated that commanders in the field would have more incentive to return depot level reparables for repair if they were required to pay for replacements and knew that their costs would be offset only by the credit given for the unserviceable item. During a test in 1981-82, the Navy, in fact, reported a 12 per cent increase in unserviceable returns, which meant that more requirements were being satisfied by repairs and fewer by procurements. The Navy also reported a 10 per cent reduction in customer requirements, which indicated that only items that were really needed were being ordered and that more repairs were being performed at lower levels. Both of these results contributed to an overall reduction in inventories.[49]

The Army expects similar results with stock funding of depot reparables in curtailing inventory growth and making customers more cost-conscious when placing orders for high dollar items. Customers will also make more effective "fix-or-buy" decisions since they will be required to reimburse the supply system for any new replacement parts. Return rates of unserviceable components should increase since customers will receive turn-in credit. While mission accomplishment will remain the number one priority, cost accountability will force managers at all levels to adopt a more business-like approach in day to day activities. This change is essential as declining resources cause the Army to focus more and more on the cost of doing business.

A demonstration of stock funding of depot reparables is currently underway at the 2nd Infantry Division and the 19th Support Command in Korea. The effective date for realigning all secondary items within the Army Stock Fund is 1 April 1992. At this date, units will be provided the necessary stock fund plus-up for implementation. These funds will be based on the cost of parts demanded by the unit during the previous three years, excluding the Desert Shield/Desert Storm time period.[50]

Excess Reduction Initiatives

The GAO and other audit organizations have repeatedly reported on the accumulation of excess inventory at retail level activities.[51] The GAO has reported that commanders at the retail level are not generally following Army regulations which require that excess inventory be identified and returned to the wholesale system.[52] According to the GAO, their reluctance to identify and turn-in excess stockage is based on a belief that it is better to have too much rather than too little, even if it means that others have inoperable equipment because they do not have the needed parts.[53] Also, since they have already paid for the items, there is no financial incentive to turn in unserviceable stocks.

Since the early 1980s, the Army has pursued initiatives to identify and redistribute excess items. However, the GAO reports that Army divisions are still retaining significant amounts of excess inventories. While Army initiatives such as OSC, TAV, and

RBM will assist in the redistribution of assets, an underlying cause of excess are the AR 710-2 stockage criteria which cannot provide adequate stocks to support readiness requirements. The AR 710-2 stockage criteria, together with the lack of responsiveness of the supply system, contribute to excess by undermining confidence in the supply system. In order to maintain sufficient stocks for operational readiness, there is a tendency to order more than is needed and stockpile the parts to prevent shortages.[54] The Army's "war on excess" will need to restore confidence in the responsiveness of the supply system. If this is done the incentives for hoarding will be removed.[55]

IV. Relating Repair Parts Initiatives to Supply System Processes and Key Issues

Based on the previous discussion, each repair parts supply initiative can be associated with different supply system processes and issues. Relating the repair parts initiatives to supply processes and common issues will assist in defining the integrating relationships and concepts between the various initiatives.

The repair parts initiatives which have been presented will influence three processes of the supply system: distribution, requirements distribution, and funding. The matrix in Figure 1 associates each initiative with its corresponding process. As shown in the matrix, most of the initiatives are associated with

Figure 1.
Relating Repair Parts Initiatives to Supply Processes

Supply Process	Repair Parts Initiative: Combat ASL/PLL	STA	BSS	OSC/ TAV	SFDLR	RBM	UBRD	Low Density Support	Excess Reduction
Distribution			X	X		X			X
Requirements Determination	X	X					X	X	X
Funding					X				

STA-Sparing to Availability
BSS-Battlefield Spares System
OSC/TAV-Objective Supply Capability /Total Asset Visibility
SFDLR-Stock Funding of Depot Level Reparables
RBM-Readiness Based Maintenance
UBRD-Usage Based requirements determination

a single primary process.

Several common issues can also be identified which link these supply initiatives:

- How should the supply system support wartime requirements?
- How can retail inventory costs be reduced?
- How can the retail supply system maintain readiness and responsiveness to the customer?
- How can inventory excesses be controlled?

The matrix in Figure 2 identifies the supply initiatives that are related to each issue. The Battlefield Spares System, by incorporating the capabilities of OSC, TAV, and STA, addresses all of the key issues. Other initiatives are tied together by one or more issues. In the next section, the discussion will show more specifically how these initiatives complement or support each other in the context of each issue. Where appropriate, modifications to the initiatives are recommended.

V. Integrating Issues

How Should the Supply System Support Wartime Requirements?

In meeting wartime requirements, the future Class IX supply system must address the changing Army mission and the requirements of AirLand Operations doctrine. The new national military strategy with its emphasis on power projection of a CONUS-based force will require rapid response to a variety of threats. Battlefield doctrine under AirLand Operations will

Figure 2. Integrating Issues

Integrating Issue	Initiative							
	Com-bat ASL/ PII	RBM	BSS	STA	OSC/ TAV	SFDLR	Low Density Support	Excess Reduction Efforts
How should the supply system support wartime requirements?	X	X	X					
How can retail inventory costs be reduced?		X	X	X	X	X		X
How can the retail supply system maintain readiness and responsiveness to the customer?		X	X	X	X		X	
How can inventory excesses be controlled?			X	X	X			X

require increased flexibility and response of supply systems.

The Combat ASL/PLL program, Readiness Based Maintenance, and the Battlefield Spares System specifically address these issues. The Combat ASL/PLL program was intended to provide the increased stockage levels for wartime operating tempo and combat damage requirements. The Battlefield Spares System (BSS) is intended to be the overall retail supply management concept for stocks during wartime and peacetime operations. The BSS can accept whatever stockage levels are considered adequate for wartime sustainment, whether these stocks are developed by the Combat ASL/PLL program or by other criteria. Although the BSS and the Combat ASL/PLL program have not been formally linked, the Combat ASL/PLL concept is a natural complement to the BSS requirement for predictive stocks.[56]

The Combat ASL/PLL program was conceived in the early 1980s when there was serious concern about the Soviet Union's growing capability and inclination to project military power.[57] At the same time there was concern about the readiness of U.S. forces to counter this threat. In testimony to Congress in 1981, the CINC USAREUR stated:

> I believe that we have designed a system that can provide for the reinforcement and sustainment of our forces but one that cannot function fully today because of resource limitations. ... We do not at this time have the system equipped, stocked, and prepared sufficiently to guarantee success in extended combat operations.[58]

Although the security environment has changed significantly since the early 1980s, a Combat ASL/PLL remains a critical

concept for the forward deployed forces, reinforcing forces, and contingency forces required by the new national military strategy.[59] These forces, in order to represent a credible deterrent, must have the required repair parts to support combat operations. Contingency forces in particular, with the responsibility for responding rapidly to a variety of threats, will require immediate access to repair parts for sustaining combat. The peacetime quantities of repair parts on ASLs and PLLs, if not augmented to account for increased usage and battle damage, will not be sufficient for wartime contingencies. Analysis has shown that many of the parts needed for battle damage are low- or no- failure items that generate no demands in peacetime and, therefore, are not currently stocked.[60]

While the Army has not successfully implemented a Combat ASL/PLL program, the Air Force has recognized the importance of wartime spares by fielding squadrons of aircraft with War Readiness Spares Kits (WRSK). These kits augment peacetime operating stocks for use during wartime.[61] The Air Force uses a cost-optimization model similar to the Army's Combat ASL/PLL computation model to produce the least cost stockage lists that will provide the required wartime readiness.

In considering requirements for wartime ASL/PLL stockage, we should avoid the situation encountered during Operation Desert Shield when the wholesale depots were flooded with requisitions by units in Saudi Arabia which had significantly increased their operating tempo without adequate stocks of repair parts.

Fortunately, there was sufficient time for the Army Materiel Command to prepare push packages of repair parts for the deployed units. These packages of repair parts were developed with the same Combat ASL/PLL model which the Army had developed but never implemented in the field.

The need for a Combat ASL/PLL program is further reflected in the U.S. Army Posture Statement for FY 92-93 which emphasizes the importance of sustaining near-term readiness as the Army "builds down". Previous large Army restructurings after World War II, Korea, and Vietnam resulted in a significant decline in warfighting capabilities and avoidable casualties when U.S. forces were committed to unexpected combat.[62]

While recognizing the need to provide an ASL/PLL augmentation of repair parts for combat, it is also apparent that changes are required to adapt the Combat ASL/PLL program of the 1980s to the reduced threat and force structure changes of the 1990s. Combat ASL/PLL requirements should be developed for the particular needs of the forward deployed forces, contingency forces, and the reinforcing forces as defined by the new national military strategy.

Combat ASL/PLL requirements for forward deployed forces should reflect the operating tempo and combat damage of appropriate wartime scenarios. Given the increased warning time of hostilities, these stocks would not have to be positioned forward in the ASLs. The stocks could be identified for each division and maintained in theater depots. These stocks would

also be critical for supporting the capability to reinforce from forward locations, as demonstrated with the deployment of the VII Corps from Europe in support of Operation Desert Storm.[63]

For regional contingency forces, the Combat ASL/PLL could be configured as tailored scenario packages for each division and stored in CONUS depots for issue in crisis response. Scenario-tailored packages could be provided for different environments, such as desert, tropics, or temperate. Similar packages could be configured for reinforcing and reserve divisions in CONUS.

Based on the experience of Operation Desert Shield when many support units deployed with inadequate or no ASLs at all, the Combined Arms Support Command (CASCOM) has developed a similar proposal for deployment ASLs to support the FORSCOM contingency corps.[64] Under this proposal, the Army Materiel Command (AMC) would develop ASL requirements for each direct support unit (DSU) based on appropriate contingency scenarios. These stocks would be stored in CONUS depots under protected levels sufficient to sustain combat operations for up to 30 days. Storage containers with drawers, bins, and shelves would also be stored in CONUS depots and used to ship deployment ASL stocks. In the event of a deployment from CONUS, units would deploy with their peacetime ASLs and PLLs. AMC would direct the CONUS depots to pack the deployment ASL. FORSCOM would determine whether the depot would ship the package to the CONUS Port of Embarkation or to the theater deployment site. In further refining this concept, mobility requirements for the stocks will have to be evaluated.

The distribution system will also need to maintain visibility of these deployment stocks to insure delivery to the correct unit. The importance of asset visibility was demonstrated during Operation Desert Storm when the distribution system lost visibility of repair part shipments at the arrival airfields and many times even at the CONUS aerial ports.[65] As of November 1991, $1.4 billion of these repair parts had been recovered from the theater.[66]

OSC, TAV, and RBM complement Combat ASL concepts by reducing the cost, weight, and size of requirements. Combat ASL requirements for a mechanized infantry division in a high intensity conflict without the benefits of OSC, TAV, or RBM are estimated to be an additional 5500 lines of stock at a cost of $96 million, weighing 1900 tons with a volume of 135,000 cubic feet.[67] The "buy-out" of a package this size is clearly not feasible from an economic or operational standpoint. However, these requirements would be significantly reduced with the reduction in OST and the decision support capability of OSC, TAV, and RBM.

As a "push" system, the Combat ASL concept must overcome historical difficulties with determining what is needed and how to redirect what is not needed. The Vietnam experience is often cited as an example where the push system resulted in waste and excess.[68] In spite of these difficulties, the Commanding General of the 1st Logistics Command, Vietnam stated that push packages, if properly developed, could be a sound concept for wartime

support.[69] Combat ASL packages for future contingencies can be improved by using field exercise data which are available to reflect the types of demands expected in combat. The uncertainty in demands that will always exist regardless of data quality can be addressed by RBM which will redirect assets as needed. The capability of RBM to enhance push systems will be further discussed in subsequent paragraphs.

The need for a Combat ASL push package in order to transition from peacetime to wartime is increasingly important with the introduction of Stock Funding of Depot Level Reparables (SFDLR). The SFDLR initiative, with its focus on financial management, will not be a viable concept during wartime. The critical urgency of spare parts in combat will require financial management concerns to be replaced by wartime readiness and sustainability priorities. The SFDLR will also promote supply and maintenance concepts during peacetime that will place units in a stockage posture not conducive to combat operations. Under stock funding, the unit will reimburse the supply system for depot level reparable parts. This requirement will provide the incentive to make additional diagnoses and repairs of expensive components. Rather than spend their stock funds on high-dollar components in peacetime, units will invest in the less expensive parts needed to repair these components. In wartime however, conditions will not allow the timely repair of critical high-dollar components. Consequently, there will be immediate requirements for large numbers of high-dollar components to

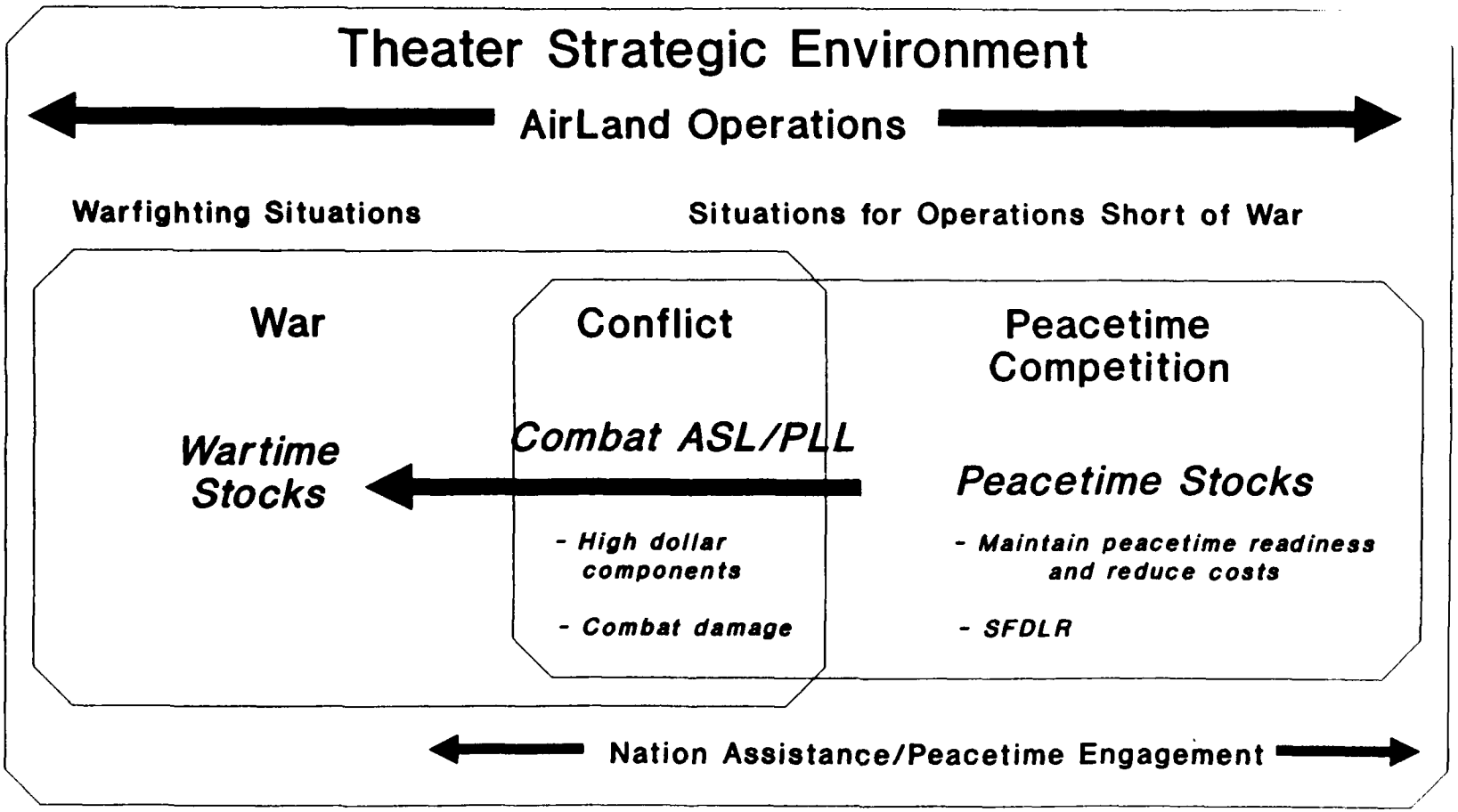
replace failed and combat-damaged components. This increases the importance of a combat ASL augmentation to make the transition to wartime. Figure 3 shows how this augmentation would support the Class IX requirements on the entire operational continuum of war, conflict, and peacetime competition as emphasized in AirLand Operations.[70]

In addition to concepts for a Combat ASL/PLL, the Battlefield Spares System is a key initiative related to the issue of repair parts support in wartime. Although the Battlefield Spares System (BSS) was developed independently of the Combat ASL/PLL program, the two concepts are complementary. The Combat ASL/PLL stocks can satisfy the BSS requirement for "predictive ASLs" tailored to the combat mission and operating tempo.[71] Selected items on the Combat ASL/PLL would also be appropriate as the on-board spares required by the BSS.

The Battlefield Spares System also serves to link the Combat ASL/PLL to battlefield maintenance doctrine under AirLand Operations. Under the AirLand Operations Combat Service Support (CSS) concept, the control of CSS functions is considered to be a burden and distraction to the maneuver commander as he tries to focus on the battle.[72] In order to narrow the "battle focus" of commanders, the AirLand Operations CSS concentrates all logistics functions in the Forward Support Battalion (FSB) which provides direct support to the brigade. The maneuver commander's focus is reduced to prosecuting the battle.

The maintenance concept under this logistics doctrine has

Figure 3. Class IX Supply for the Operational Continuum of AirLand Operations



been designated by the Ordnance Center and School as the Battlefield Maintenance System (BMS). The BMS transfers maintenance responsibility from the combat-arms commander to the maintenance unit commander in the FSB. All maintenance personnel will be assigned to maintenance units in the FSB. This consolidation allows for a single point of contact and responsibility for maintenance requirements. The BMS will replace the current 5-level maintenance system (operator, organizational, DS, GS, and depot) with a 4-level system. The four levels will be operator, field, general support, and depot. Field maintenance will combine the former organizational and DS levels. Combat maintenance companies in the FSB will perform field level maintenance (organizational and DS) for the combat battalions of the brigade. This provides an enhanced capability to fix forward on the battlefield.[73]

The Quartermaster Center and School developed the Battlefield Spares System to be consistent with this new maintenance doctrine by giving all control and visibility of stocks to the FSB. All deliveries of parts will be under the operational control of the FSB in its maintenance mission. BSS thus supports the AirLand Operations concept for unburdening the brigade's maneuver and combat support commanders so that they can concentrate on essential combat tasks.

OSC, TAV, and RBM further support the key sustainment imperatives of AirLand Operations: responsiveness, anticipation, and improvisation.[74] These imperatives reflect the requirements

of the non-linear battlefield with large gaps between forces requiring real-time visibility of logistics in motion.[75] The OSC and TAV provide increased responsiveness to changing needs by decreasing requisition time and thereby enhancing the capability of units to "pull" from the supply system. The imperatives of anticipation and improvisation are a response of the Combat Service Support (CSS) system to Clausewitz' concept of friction in war:

> Countless minor incidents-the kind you can never really foresee-combine to lower the general level of performance, so that one always falls far short of the intended goal.[76]

The potential for friction in logistics support of Airland Operations is greatly increased by the complexity of weapon systems, the uncertainty of demands, and the long distance between units on the non-linear battlefield. The RBM provides a means to overcome friction with a decision support system to anticipate requirements and improvise on the battlefield. The RBM concept will use readiness data, demand rates, and repair times to produce decision recommendations for repair and distribution priorities based on the requirements of units with the greatest need. RBM will provide the capability to reflect the priorities of different units in the combat theater as opposed to the current supply system which does not differentiate between units with varying combat intensities and different missions. As opposed to OSC and TAV which support the requisition "pull" from the supply system, RBM is a proactive "push" system to respond to combat requirements.

The pull-push combination of OSC and RBM is a unique characteristic of the evolving concept for wartime support. The OSC and RBM capabilities are intended to overcome the problems of previous pull and push systems during wartime. For example, the requisition pull during Operation Desert Storm was costly and non-responsive. The supply pipeline to Saudi Arabia cost $23 million per day with 10 to 12 days needed to simply get a requisition out of theater.[77] The asset visibility and distribution problems during Desert Storm were also similar to problems during World War II as described by General Joseph Heiser, former DA Deputy Chief of Staff for Logistics:

> ...we often didn't know what we had or where it was. Needed critical items were probably on the beaches in front of our eyes...All across Europe identifying stock on hand in the combat zone was a problem, making it necessary to request rush shipments of supplies that were probably available.[78]

The push systems employed in Vietnam and Korea were also plagued by problems. As mentioned previously, the push distribution concept employed in Vietnam was characterized by "excesses and all the associated management problems indigenous with a bloated inventory."[79] During the Korean war, "ships were used uneconomically and piled up in the harbor of Pusan, while some non-critical items were shipped ahead of more important ones."[80]

As discussed in conjunction with the Combat ASL, RBM will alleviate the excess inventory problem caused by previous push systems by providing visibility of assets and a decision support system to make optimal redistribution decisions based on weapon system availability. By distributing repair parts to units with

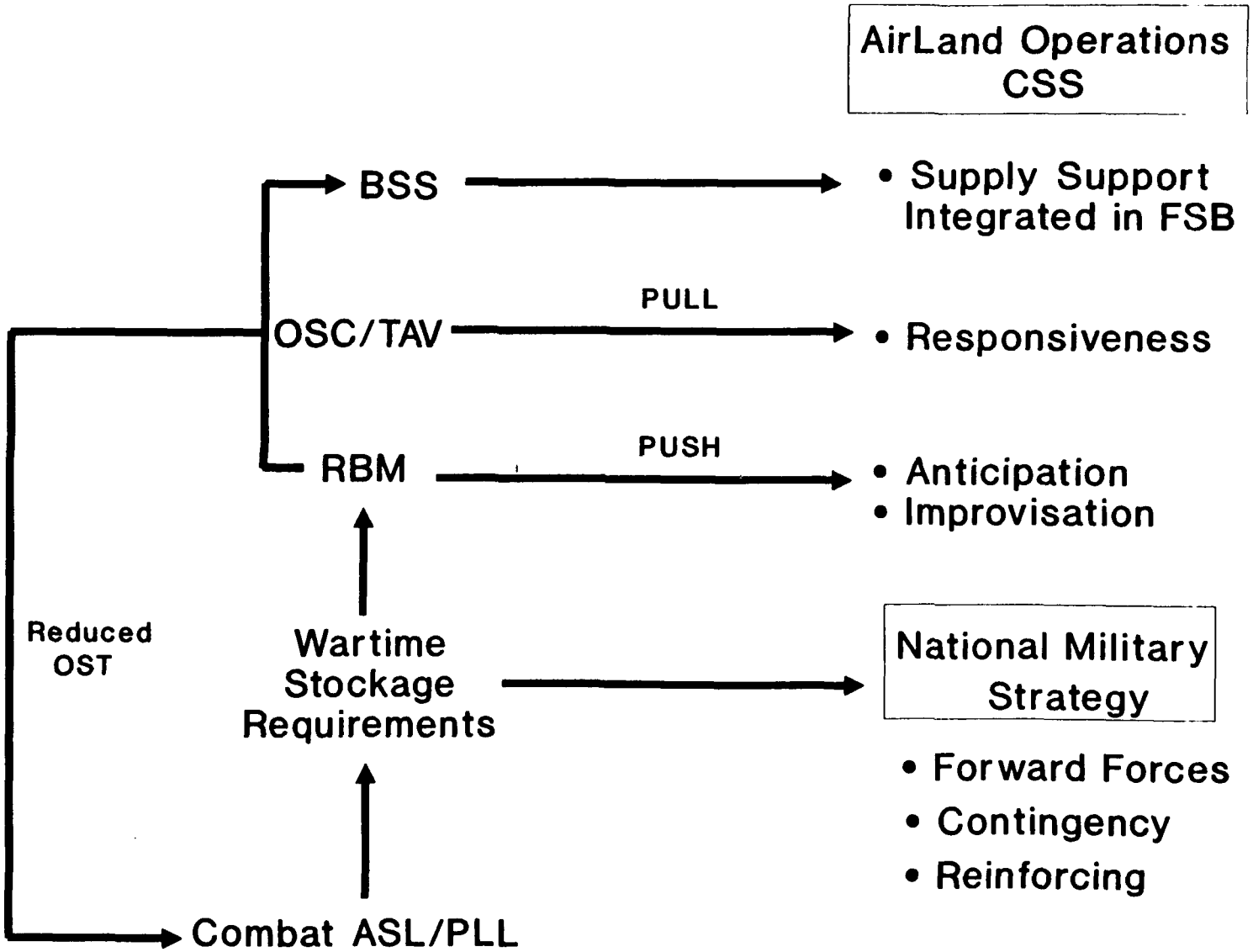
the greatest need, RBM applies the principle of economy of force to Class IX supply. In terms of combat forces, economy of force allocates minimum essential combat power to secondary efforts. In the same manner, RBM will allocate fewer critical parts to lower priority units. RBM thus addresses the need for economy of force in logistics as recommended by General Heiser:

> ...we must stress that logistics should be included when the Army speaks and teaches economy of force, ...Leavenworth is combat oriented and its teachers rarely even consider logistics. When they do, they by and large subscribe to the idea of "mass logistics", that is, "we don't know the logistics requirements, so just load the system (create a 'mass') and, inevitably what we need will be there." The Army must turn this thinking around and stress the economy of logistics force along with the economy of combat force if it is to ensure the highest level of readiness.[81]

While RBM will improve the push system, OSC will overcome the problems of previous pull systems. OSC will streamline the requisition process to provide immediate processing of requests from the customer to the source of supply, furnish the status of each request to the customer, and ensure that locally available assets are issued before a request is placed to the next level of supply.

The integration of these initiatives for wartime support thus results in a combined push-pull concept. The Combat ASL and RBM comprise the push system for initial requirements. A requisition pull with improvements under OSC can provide subsequent resupply. Battlefield management of the stocks is accomplished under BSS. Figure 4 further illustrates the wartime support relationships between Combat ASL/PLL, the Battlefield Spares System, Readiness Based Maintenance, Objective Supply

Figure 4. Wartime Support Relationships



Capability, Total Asset Visibility, and the logistics requirements of AirLand Operations.

How Can Inventory Costs Be Reduced?

In the current environment of declining resources, the need to reduce inventory costs has become a dominating concern. Cost reduction has consequently become a key issue in most Class IX initiatives.

The Battlefield Spares System (BSS) initiative incorporates sparing to availability (STA) as a stockage process to meet weapon system operational performance targets at least cost.[82] Studies have shown sparing to availability to be a significant source of inventory savings.

As discussed previously, sparing to availability is an optimization method to produce the stockage requirements for achieving a desired weapon system availability at least cost. The AMC Commanding General has directed that all Major Subordinate Commands use sparing to availability for the 2-year initial provisioning period of newly fielded systems. Table 1 shows the cost savings that are possible with sparing to availability for initial provisioning. The table gives the initial provisioning cost with sparing to availability as compared to standard initial provisioning for 316 Bradley Fighting Vehicles in an armored division.

Table 1. Bradley Initial Provisioning Evaluation[83]

	Retail Cost	Operational Availability
Sparing to Availability	$ 2.2M	0.90
Standard Initial Provisioning (SIP)	$ 2.9M	0.43

Standard Initial Provisioning (SIP) computes stockage quantities based on meeting a specified number of demands during a year. There is no consideration of weapon system availability. Consequently $2.9 million worth of stockage yields an availability of only 43 percent.

Sparing to availability calculates the initial stockage needed to achieve the required Bradley availability of 90 per cent. As shown in the table, it is possible for the Bradley to achieve the availability requirement by only spending $2.2 million. Not only is this $0.7 million less than required by the standard initial provisioning, but the optimum selection of parts also increases the availability from 43 to 90 per cent.[84]

Further substantial savings are possible with incorporation of sparing to availability into the retail replenishment system to replace the current demand-based stockage criteria of AR 710-2. The Army Materiel Systems Analysis Activity (AMSAA) has developed an ASL using sparing to availability for an infantry division.[85] Based on high priority requisitions, a comparison of this ASL with the actual on-hand ASL of the

division shows a cost reduction of $9.0 million. However, since sparing to availability tends to increase the range of parts, about 3500 new lines of parts are added to the ASL. The apparent anomaly of a cost reduction at the same time that lines are significantly increased is a result of the cost optimization and readiness priorities which are characteristic of sparing to availability. The sparing to availability procedures will trade-off a small number of high cost parts for a greater range of less expensive parts which are needed to insure that readiness requirements are met. Table 2 compares the number of lines, weight, cube, and cost for the sparing to availability ASL and the on-hand ASL in the division. Although STA results in an increase of lines, there is only a small increase in weight, and the cube is actually reduced. However, there is still concern with the impact of the additional lines on mobility and stock management. Since many of these lines have a depth of only 1 or 2, their impact on the forward ASLs could be lessened by stocking them at the main ASL.

While the sparing to availability concept for the retail system offers the potential for large cost reductions, further refinement of the concept is required through a field test and demonstration with an active Army division. Tests are currently being planned by AMSAA and SLA for the National Training Center, the 5th Mechanized Infantry Division, the 2nd Infantry Division, and the 7th Infantry Division.

The Objective Supply Capability (OSC) and Total Asset

Table 2. STA vs. Actual Stock Levels
High Priority Requisitions Only

STA Levels

Location	Lines	Cube	Weight	Dollars
Main	7,175	50,099	1,476,992	$11,515,553
FWD 1ST	3,251	4,993	171,248	$1,731,938
FWD 2ND	2,771	3,021	60,044	$387,878
FWD 3RD	2,918	2,554	80,450	$1,259,102
Aviation	3,102	4,235	41,646	$4,007,801
Missile	1,390	1,978	25,641	$4,338,702
Total	10,977 *Unique*	66,880	1,856,021	$23,240,974

Actual Levels (Aug 91)

Location	Lines	Cube	Weight	Dollars
Main	5,746	55,594	1,468,080	$13,555,421
FWD 1ST	922	4,428	126,208	$1,956,051
FWD 2ND	694	1,801	39,374	$625,856
FWD 3RD	690	4,535	132,455	$2,403,807
Aviation	1,475	5,283	36,436	$4,415,473
Missile	451	2,462	28,820	$9,542,384
Total	7,584 Unique	74,103	1,831,373	$32,498,992

Visibility initiatives are expected to have a direct impact on reducing costs by allowing lateral resupply and reduced order and ship times which will decrease the required level of stocks. Regarding asset visibility, the DMR Implementation Report stated:

> ...a key to improved inventory management is increased visibility of assets. If the item manager can look into the retail, wholesale, and operating stocks, decisions to redistribute can be made rather than a decision for a new procurement. This reduces lead time, costs, and inventory levels.

Sparing to availability is related to OSC and TAV by its use of the order and ship time achieved through OSC and TAV to compute the required stockage levels. Sparing to availability will, in turn, be the basis for stockage levels under the Battlefield Spares System management concept.

The Usage Based Requirements Determination (UBRD) effort can also be viewed as a cost savings initiative in terms of the increased data accuracy which it will provide for provisioning and replenishment models such as sparing to availability. The improved data accuracy will result in more efficient stockage decisions and reduced investment in unneeded stocks.

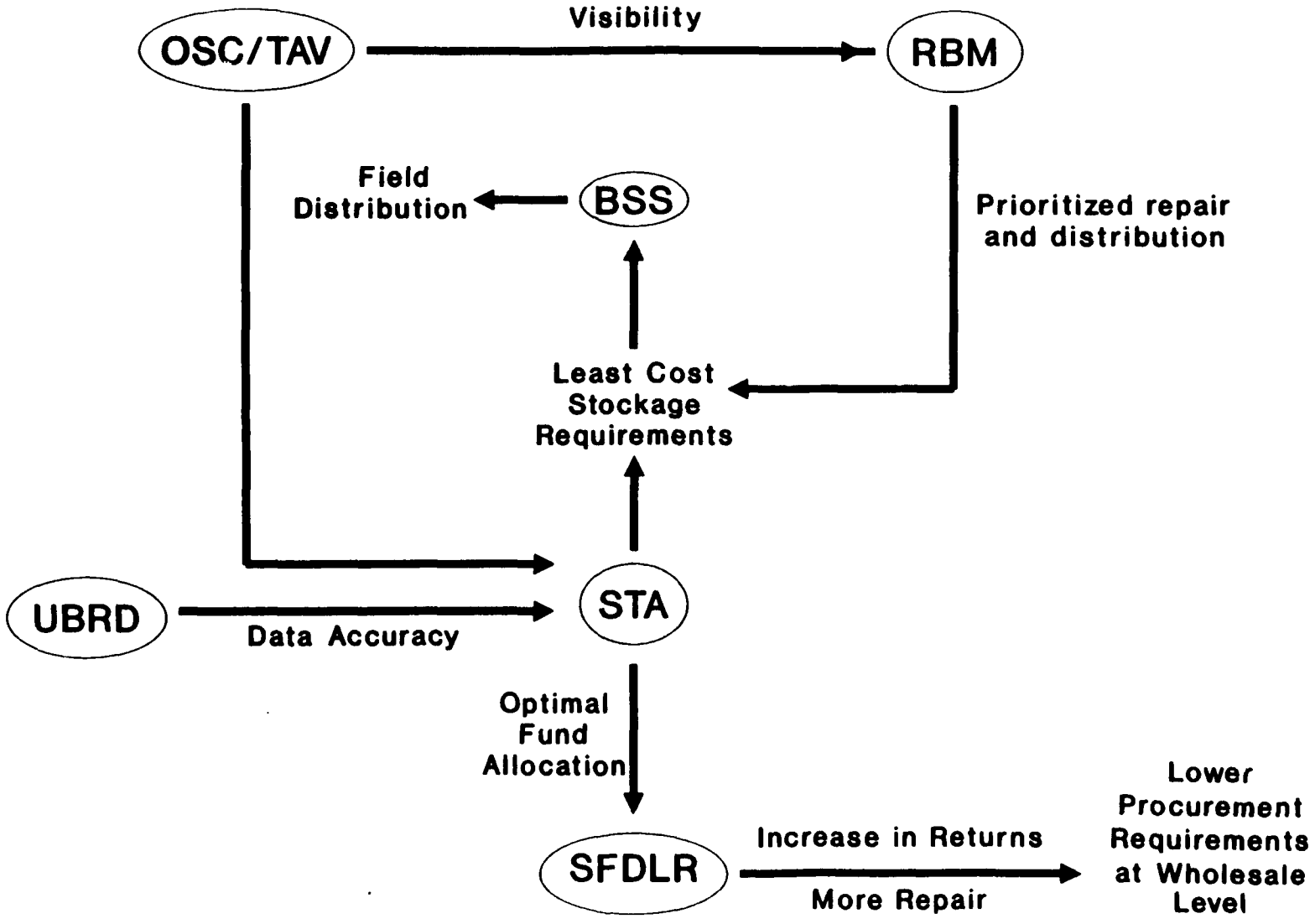
The Readiness Based Maintenance concept is also recognized as a means to save inventory investment through prioritized repair and distribution of high cost components. TAV will provide RBM with the visibility of these components in the retail and wholesale system. Without a decision support system such as RBM, the only alternative to maintaining system readiness is the costly "buy-out" of sufficient spares. The RAND Corporation has conducted combat simulations of M1 tank operations in a corps

which establish the cost effectiveness of an RBM system. The RAND studies show that the additional costs for a RBM system would be less than 25% of the cost associated with an attempted "buy-out" of stocks needed to achieve the same weapon system availability. In this limited scenario study, the savings over a "buy-out" of stocks would approach $180 million for each corps. Extrapolating this cost advantage over all corps and extending its use to several weapon systems indicates that an RBM system could be extremely cost-effective.[86]

The Defense Management Review directed the implementation of Stock Funding of Depot Level Reparables (SFDLR) as a cost savings measure under the concept that a "paying user buys less".[87] Savings are expected based on the incentive for customers to make more cost-effective repair versus buy decisions. The unserviceable return rate is also expected to increase which would provide more assets to the wholesale level and reduce procurement expenditures. The potential for cost savings with a higher unserviceable return rate was cited in a recent report by the GAO.[88] In a review of four of the Army's six inventory control points, the GAO found that they were buying between $369 million and $815 million of assets that need not have been bought if returns had been at the 85% goal.[89]

Sparing to availability in the retail system will complement the SFDLR initiative by providing the user with the most cost-effective allocation of stock fund dollars. Sparing to availability will also insure that units are stocked with the

Figure 5. Cost Reduction Relationships



necessary parts for a cost-effective repair capability.

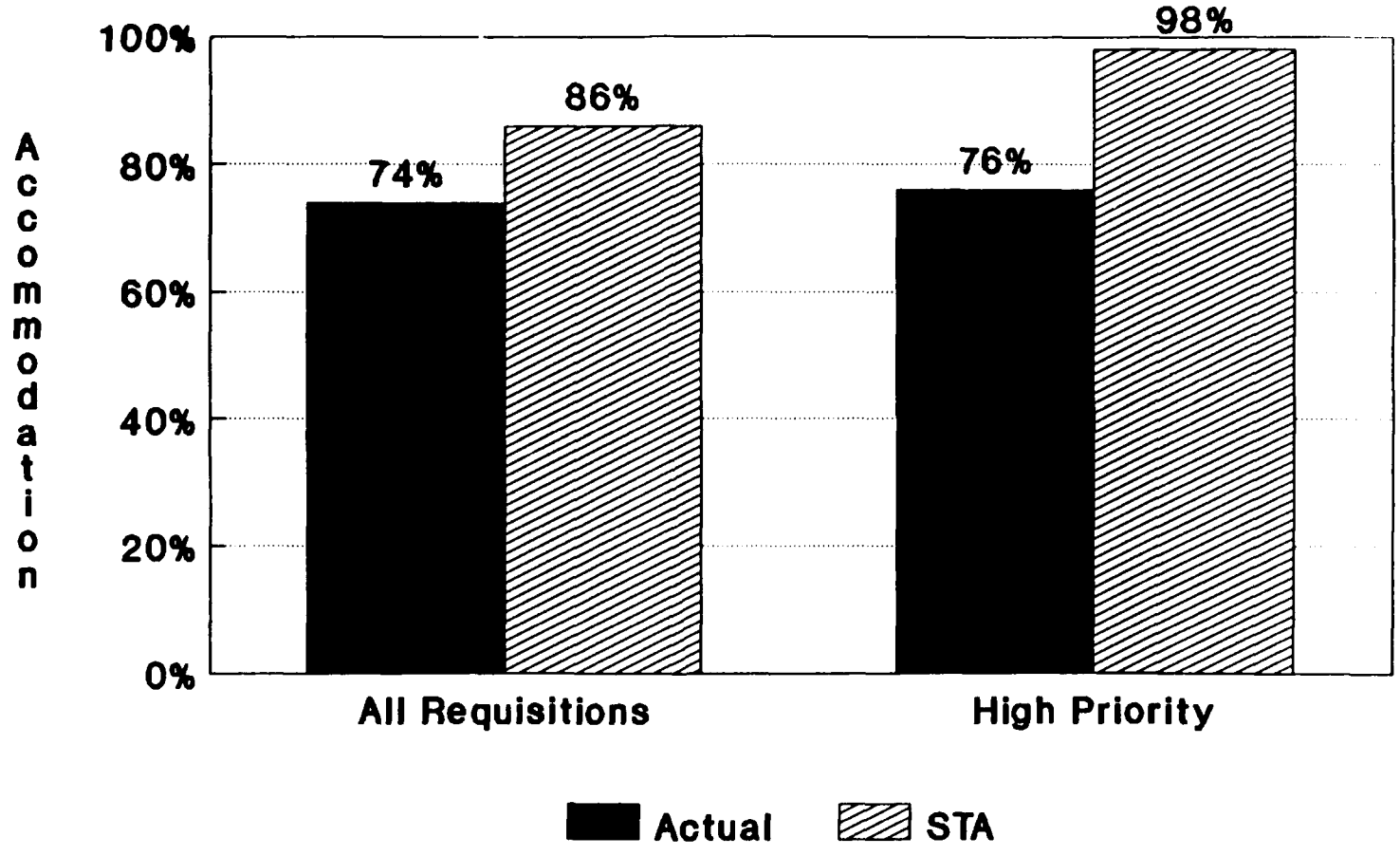
Figure 5 shows the relationships of these initiatives in reducing supply system costs.

How Can Readiness and Responsiveness to the Customer Be Maintained?

While most of the initiatives support readiness, the key supply concept for maintaining readiness in the face of declining budgets is sparing to availability. Sparing to availability specifically provides the required stockage to achieve a readiness goal. The previous discussion used actual demand data from an infantry division to show how sparing to availability can be applied in the retail system to achieve significant cost reductions. The same data can show the readiness-enhancing features of STA. The demand accommodation of the STA-based ASL was compared to the demand accommodation of the actual on-hand ASL based on current retail supply criteria in AR 710-2. As shown in Figure 6, the demand accommodation for high priority requisitions with the ASL based on STA was more than 20% higher than the accommodation of the actual on-hand ASL.[90]

The low density support initiative of TACOM is an application of sparing to availability stockage to improve readiness. From April 1991 through September 1991, TACOM conducted a test with the 4ID at Ft. Carson on ways to improve the readiness of low density systems. A supplemental package of parts was developed with sparing to availability methodology for

Figure 6. Accommodation Performance
Actual ASL vs. Full STA
(Based on 2 Years of Demand Data)



Supply Accommodation --> Readiness

three low density vehicles: the Armored Vehicle Launch Bridge (AVLB), the Combat Engineer Vehicle (CEV), and the M916 truck. Table 3 compares the number of days that the equipment was available with and without the supplemental package.

Table 3. Benefits of Low Density Support Package[91]

Vehicle	Possible Days	Available Days w/ Package	Available Days w/o Package	Additional Available Days
AVLB	2850	2349	2196	153
CEV	900	639	548	91
M916	1350	908	724	184

As expected with a sparing to availability concept, the low density support package improves the availability of the supported equipment. The implementation of sparing to availability in the retail system will meet the objectives of the low density initiatives which have been independently pursued by TACOM.

The Objective Supply Capability and Total Asset Visibility will improve readiness by facilitating lateral resupply of parts and reduction of order and ship times. STA, OSC, and TAV are all integral parts of the BSS.

STA and lateral resupply through OSC are of increasing importance considering the variability in demands of expensive components in modern weapon systems. Parts demand data in the

Army and Air Force raise questions about the stability of the peacetime demand process and the ability to predict future needs on the basis of historical data.[92] STA can mitigate these effects by providing a much wider range of parts than current demand-based supply policy. The difficulty in forecasting the demands of expensive components makes lateral resupply and asset visibility an essential measure to maintain readiness.

The unpredictability of demands also makes Readiness Based Maintenance a key initiative in maintaining readiness as budgets decline. RBM will recommend priorities for distributing existing serviceable assets, repairing unserviceable assets, and redistributing repaired assets to improve weapon system readiness where it is most needed. Simulations at the DS level show that RBM can maintain high weapon system availability even with substantial cuts in resources. Other simulations at the theater level and the depot level demonstrate similar capability of RBM to dramatically increase readiness.[93]

While STA, RBM, OSC, and TAV will enhance readiness, the SFDLR initiative may result in trade-offs that will degrade readiness.[94] A difficult decision will be required whether to lose time (and readiness) by repairing or lose money by replacing. The training of diagnosticians and maintainers becomes critical to prevent long repair times that will decrease readiness. Another consequence of SFDLR which affects readiness is the increase in DS and unit maintenance workload at a time when many maintenance activities are already overloaded.[95] The

problem is worsened by a shrinking Army in which there will be a smaller percentage of maintainers than currently exists.

The impact of SFDLR on readiness can be minimized by the prompt implementation of readiness-enhancing initiatives such as STA, OSC, TAV, and RBM.

How Can Inventory Excesses Be Controlled?

Studies by the GAO have reported that the Army accumulates and retains excess inventory at retail-level activities.[96] The excess inventory is defined in terms of stockage levels exceeding those allowed under AR 710-2. The Army, in response, has dedicated considerable effort to uncover and eliminate excess stocks.

However, the excess stocks are often needed to maintain readiness standards since the demand-based stockage levels of AR 710-2 are not adequate. Previous excess reduction efforts based on the definition of excess under AR 710-2 have not been consistent with sparing to availability and non-demand based stockage to support wartime contingencies. Continuation of these same excess reduction efforts is supported by a recent GAO report that recommends eliminating non-demand based stocks from the division.[97] The justification is that only 16 per cent of these stocks had high priority demands. These parts, according to the GAO, could be provided by expedited transportation. Rapid delivery is certainly a means to reduce the overall level of stocks, but it should be used in the development of optimal stock

levels under STA. The GAO insistence on demand-based criteria will only serve to maintain a more costly inventory. The demand-based criteria of AR 710-2, in fact, is a cause of inventory excess because of the inherent variability in demands of parts.[98] Parts which meet the demand criteria one year are likely not to meet the criteria in following years and thus are declared excess.

Initiatives such as STA, OSC, TAV, and RBM are designed to pursue the same goal as the GAO excess reduction efforts but with an approach which will preserve readiness and produce more cost savings. These initiatives will address the lack of confidence in the supply system which often results in duplicate requisitions and additional excess. OSC will provide real-time feedback to the user on the status of requisitions and thereby increase user confidence in the supply system and reduce the number of duplicate requisitions. The professional supply personnel under the BSS will provide additional control in the requisition process.

Figure 6 showed the improved demand accommodation with STA versus current retail stockage criteria. This indicates that stockage under STA would be more stable with fewer changes and less turbulence than with current retail criteria. This stability will result in less excess under STA-based retail replenishment.

The funding concerns of units under the SFDLR initiative will also impose discipline on requisitioning and encourage units

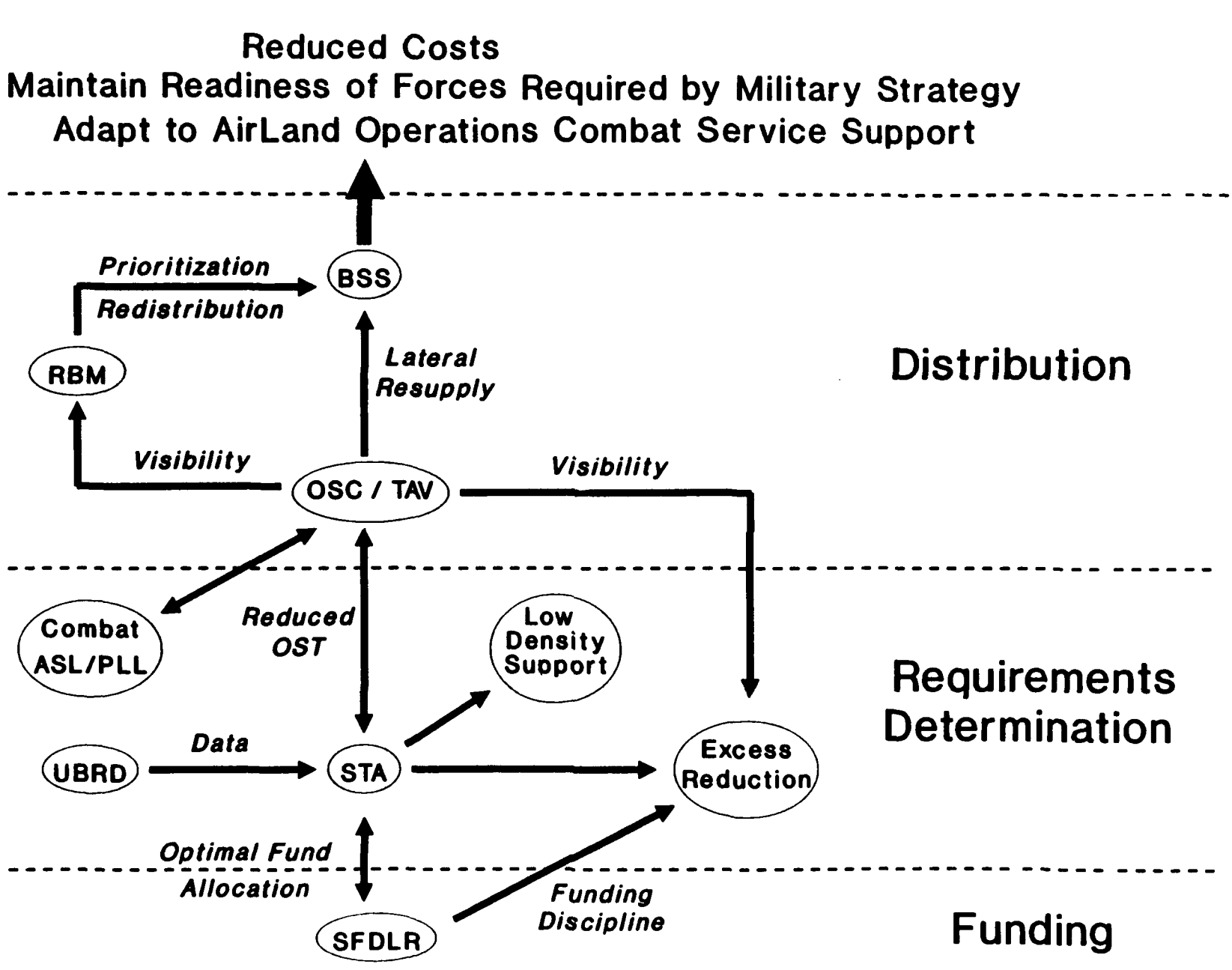
to turn in excess stocks for credit. However, having relied on excess stocks in the past, supply personnel will need a cultural change to accept that fewer stocks are acceptable with improvements under STA and OSC.

Thus far the relationships between Class IX initiatives in support of key integrating issues have been discussed. These initiatives and their related issues can also be seen in the context of an overall repair parts strategy for the Army in the 1990s and beyond. The repair parts strategy can be viewed in terms of ends, ways, and means. The ends of this strategy are the cost-effective support in peacetime and wartime of the forces required for the national military strategy - the forward deployed forces, the contingency forces, and the reinforcing forces. In wartime, the repair parts strategy must also be consistent with AirLand Operations doctrine. The ways of this strategy represent the initiatives and their integrating relationships that have been discussed. The means of this strategy can be defined in terms of the software automation, transportation improvements, and communication improvements to implement these initiatives.

The initiatives can also be represented in terms of the processes which they influence: the distribution process, the requirements determination process, and the funding process. In this respect, the initiatives comprise a Total Quality Management strategy in terms of overall process improvement.

Figure 7 summarizes the relationships of this strategy and how the initiatives complement each other. As shown in the figure, the class IX initiatives span the three processes of funding, requirements determination, and distribution. With funding under SFDLR, requirements are determined with STA during peacetime and augmented by Combat ASL/PLL stocks during contingencies. STA complements SFDLR by providing the customer with the most cost-effective allocation of stock fund dollars. The UBRD initiative complements STA by providing accurate data to the STA requirements determination process. STA also supports low density systems and applies the proper criteria for the definition of excess stocks. From the requirements determination process, distribution takes place with a combined push/pull system. The "pull" system of requisitions is supported by OSC and TAV which provide reduced order/ship time (OST) and facilitate lateral resupply. The reduced OST from OSC is fed back to STA in order to adjust the requirements levels. The "push" system of RBM uses TAV to provide asset visibility and applies the appropriate priority to repair and distribution of scarce components. BSS accomplishes the distribution of parts within the division in accordance with battlefield maintenance doctrine and the requirements of AirLand Operations. The integration of these initiatives through the processes shown in Figure 7 accomplishes the desired end of reduced costs, maintaining readiness in support of the national military strategy, and adherence to AirLand Operations doctrine.

Figure 7. Integration of Class IX Supply Initiatives



In supporting the Army mission under the national military strategy as well as the tenets of AirLand Operations, these initiatives accomplish the critical linkage of logistics to strategy and tactics. Regarding the importance of this linkage, James Huston states:

> Strategy and tactics and logistics are different aspects of the same thing. If completely separated they become meaningless...
>
> Strategy, tactics, and logistics stand at the points of a triangle, or perhaps it would be more accurate to say that they comprise three arcs of a circle, without beginning or ending, each arc influencing, and influenced by, each of the others.[99]

VI. Conclusions

Based on the relationships in Figure 7, the class IX retail supply initiatives comprise an integrated process and coherent strategy for achieving the following objectives:

- Reduce costs
- Maintain readiness in support of the forces required by the national military strategy.
- Support AirLand Operations.

However, the coherence of these initiatives depends on maintaining the priority of wartime readiness initiatives such as Combat ASL and RBM in order to balance the peacetime efficiencies of SFDLR. The integration of these initiatives also requires the re-orientation of excess reduction efforts to be consistent with sparing to availability and non-demand based stockage requirements for combat contingencies. This will require a

change in retail stockage regulations and stockage excess criteria. Because of demand variability, the current demand-based stockage excess criteria in fact worsens the problem of excess. The underlying objective of excess reduction, i.e., the reduction of inventory investment, is best achieved by STA criteria. Inventory reduction will be further enhanced as lateral resupply, asset visibility, and rapid delivery are implemented through OSC, TAV, and BSS. These initiatives will increase the confidence in the supply system and reduce the tendency to maintain excess stocks as insurance against shortages. Stock funding of depot level reparables will also provide the financial incentive for units to turn in excess.

In emphasizing weapon system readiness, support of wartime contingencies, flexibility, and responsiveness, these initiatives provide the potential for an effective linkage of logistics support to national military strategy and battlefield operations. In addressing both wartime and peacetime needs, the initiatives support the most recent AirLand Operations doctrine for the entire operational continuum of war, conflict, and peacetime competition.

Significant inventory cost savings are possible through sparing to availability and the reduced order-ship times expected from the Objective Supply Capability and Total Asset Visibility. Stock funding of depot level reparables should provide further economies through more cost-effective repair or buy decisions. STA complements the stock funding of depot level reparables by

providing units with the greatest flexibility and return on their stock investment.

Stockage for combat is still a valid requirement but the Combat ASL concept of the 1980s should be adapted to the particular needs of the forward-deployed forces, the contingency forces, and the reinforcing forces under the new national military strategy. The Combat ASL, in conjunction with RBM and OSC, provides the basis for a combined push-pull concept for wartime support. The Combat ASL package, operating under RBM, provides the initial push of repair parts. Requisition pull enhanced by OSC provides subsequent resupply. The stock funding of depot level reparables (SFDLR) will not be a viable concept during wartime, thereby increasing the importance of a Combat ASL/PLL to make the transition from peacetime to combat. Under SFDLR, peacetime cost efficiencies will promote stockage of less expensive parts for repair of high-cost components. Wartime conditions, however, may prevent timely repair of these high cost components when they are most needed. A combat ASL package can provide those parts for wartime operations that may not otherwise be available in the unit.

The repair versus buy decisions under SFDLR may degrade readiness. This increases the importance of implementing readiness-enhancing initiatives such as STA, OSC, TAV, and RBM in order to mitigate this degradation. The implementation of STA in the retail system will also solve the readiness problems of low density systems which have been addressed by CECOM and TACOM.

By incorporating sparing to availability and stockage augmentation for wartime, the Battlefield Spares System represents an overall repair parts management concept that provides the linkage to AirLand Operations doctrine for combat service support. The OSC, TAV, and RBM also support BSS in providing the enhanced visibility and responsiveness required for AirLand Operations.

VII. Recommendations

While this paper has addressed only supply initiatives, other support resources including transportation and maintenance should be considered together with repair parts in logistics support planning. Trade-offs between these resources will be needed to achieve the most cost-effective and responsive support in peacetime and combat. Software automation support and command, control, and communications also must be considered in implementing the various repair parts initiatives.

Many of the repair parts initiatives that have been discussed such as STA, OSC, TAV, RBM, and BSS have only been tested in a limited manner or have not been tested at all. A structured test program should be developed within a division or corps as appropriate to determine the implementation requirements for an operational environment. The initiatives should be tested individually and then simultaneously as a complete integrated system. This test program should also integrate maintenance,

transportation, software support, and command, control, and communications.

Sparing to availability and new Combat ASL policy should gain additional emphasis for implementation. Sparing to availability in the retail system is critical for reducing costs, maintaining readiness, and supporting the stock funding of depot level reparables. Retail stockage policy in AR 710-2 should be changed to allow implementation of sparing to availability. Policies for excess reduction should also be revised to be consistent with STA and non-demand based stockage for combat contingencies.

Class IX support for wartime should be established through a combined push-pull concept with Combat ASL and RBM (push) and OSC (pull). The need for combat stocks to transition to wartime is increasingly important with the emphasis on peacetime efficiency initiatives such as stock funding of depot level reparables. Combat ASL/PLL packages should be developed for forward deployed, contingency forces, and reinforcing forces. These stockage lists should be based on wartime operating tempos and scenario-based combat damage requirements. As suggested by CASCOM, these packages could be stored in CONUS or theater depots until needed for combat operations.

With the potential for SFDLR to degrade emphasis, priority should be given to implementing the primary readiness-enhancing initiatives of STA, OSC, TAV, and RBM.

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